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A Healthy Mix?

Health Food Retail and Mixed Use Development: Mobility-related Analysis of Grocery Shopping Behavior in Irvine, California

NETWORK FOR EUROPEAN-U.S. REGIONAL AND URBAN STUDIES (NEURUS)

REPORT

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Abbreviations

AB 32	Assembly Bill 32 – California Global Warming Solutions Act
EIR/EIS	Environmental Impact Report / Environmental Impact Statement
GHG	greenhouse gas
IBC	Irvine Business Complex
MKT	Monthly kilometers traveled
MMI	Mother's Market Irvine
MXD	Mixed use development
OC	Occasional consumer of the mixed use centered specialty store
OTH	other stores
RC	Regular consumer of the mixed use centered specialty store
SB 375	State Bill 375, State of California
ULI	Urban Land Institute

Summary

The climate change is spurred by many anthropogenic activities, in particular by transportation and land use patterns that are related to low-density sprawling development. These cause considerable traffic leading to rising air pollution that is, according to the IPCC “very likely” to accelerate the increase of average temperatures in the long term. In California, for example, 30% of all green house gas emissions stem from passenger vehicles. In order to address this and other consequences of the sprawl, the State of California has issued State Bill 375 that requires changes in land use and transportation patterns. Over the years several instruments to mitigate the sprawl were developed by the new urbanists. One of them, the mixed use development, is seen as a suitable planning instrument to realize the goals of SB 375. Such developments, as they consist of more than three land uses, can help to make traffic more sustainable in three mutually supporting ways , i.e., by decreasing trip distances, by increasing the use of non-motorized or non-personal modes, and by raising the proportion of trips in which more than two activities are linked. As mixed use development often requires specialty retail which in turn relies on a special customer base that is very dispersed, its traffic reduction goals can be challenged.

This research attempts to assess the traffic-related sustainability of mixed use developments by analyzing which effects a specialty store has on consumers’ shopping travel patterns. In applying a buyer decision based framework it assumes that distances traveled by consumers to a store are depending on their motivations and involvement. Thus, different types of shoppers and different types of stores theoretically result in different travel patterns as they are patronized due to varying motivations. Accordingly, this study is intended to find out to what extent consumers are motivated by built-environment variables (proximity) as compared to store-related attributes (organic/quality/specialty). In order to analyze this, an intercept survey of 120 consumers of a mixed use centered health food store was conducted in November 2009. These consumers were split into regular and occasional consumers of the health food store according to the frequency they shop at this store as opposed to other stores. Findings are as follows:

1. Health food shoppers travel significantly longer distances than other shoppers
2. Proximity variables are negatively correlated with distances for both kinds of shoppers
3. Motivations such as quality and organics are not associated with distances traveled
4. Regular consumers consisted of 83% of specialty shoppers, occasional consumers consisted of 41% of convenience shoppers and 23% of economic shoppers

5. Specialty and economic shoppers travel much longer distances than convenience shoppers
6. The differences in distances traveled are likely to be due to the more widely dispersed retail facility pattern of health food stores.
7. Consumers mostly came by car and from home and did not use any other facilities on the mixed use development. Occasional consumers linked more trips with shopping at the health food store.
8. Consumers did not walk because of the inconvenience of carrying groceries, because of wide and dangerous streets, and because they were running errands.

The following recommendations for designing sustainable mixed use developments can be drawn from these results, and interviews with a city planner and the health food retailer:

1. A mixed use development's goal to reduce traffic is challenged by the travel patterns caused by specialty retail. However, conversely, a mixed use development can also help mitigate the adverse effects specialty retail has on traffic.
2. Mixed use developments need to be coherently planned from the beginning on in order to ensure that they are primarily suitable for pedestrians, which requires that all uses are well interconnected and rather dispersed than clustered. External accessibility should also focus on public transportation. Only then are consumers enticed to locally link activities while using environmentally friendly modes.
3. A complementary retail mix can provide opportunities for multi-purpose shopping and thus substitute external shopping trips. Accordingly, retailers need to be advised on the advantages they can draw from such cooperations.

For future research, it would be desirable to conduct a comparison case study that controls for the type of store but varies in land use mix, to find out what effect mixed use development has on travel patterns. Additionally, studies could control for land use mix but vary in the type of store. Such studies would provide the opportunity to separate the specialty effect from the land use mix effect and enable scholars to give more specific recommendations on how to design mixed use development sustainable, and what traffic effects a specialty store can cause.

1 Introduction

Climate change is no doubt an important topic all over the world. Not only in emerging countries like China, but also in the developed world the triggers of climate change must be addressed. The main cause is rising emissions of anthropogenic gases that enforce the natural greenhouse effect and are "very likely to lead to above-average global warming in the long term" (IPCC 2007, p. 5). Energy is the sector that generates the most emissions, with carbon dioxide being the gas predominantly emitted. Within energy, transport, in particular road transport is the major greenhouse gas (GHG) producing sector (IEA 2009, pp. 8; 115). One third of the world's CO_2 emissions from road transport is attributed to the U.S. (cf. TRB 2010, p. 16). This high share is mainly due to the energy-intensive, culturally inherent consumption and land use patterns that have resulted in ever-sprawling cities. Large-scale, low-price stores and shopping centers that can only be accessed by car are the prevalent retail formats. Thus the use of the automobile in everyday life has become inevitable – people depend on their cars – and road transport is still on the rise. In California, for example, the transportation sector emitting the most greenhouse gases is passenger vehicles, contributing nearly 30% of all emissions (ARB 2008, p. 38). However, climate change is just one consequence, although no doubt the most serious one, of ever-increasing traffic – air pollution, health risks, and congestion are other major issues having an impact on everyday life. To reduce GHG emissions of cars it is not sufficient to only increase vehicle technology or fuel efficiency. Additionally, land-use changes have to be implemented to lower travel distances and shift transportation to more sustainable modes. With SB 375, Section 1c, planners are requested to address this (cf. ARB 2008, p. 38; STATE OF CALIFORNIA 2008, p. 4). This research aims at one planning instrument that may be able to implement SB 375's requirement to reduce GHG by reducing vehicle miles traveled, mixed use development (MXD), and is intended to probe its suitability to fulfill that role. Why MXD? European cities prove that with a good land use mix cities are more livable and less car-dependent. Accordingly, proponents of MXD's stress that by mixing land-uses, long distances between shopping destinations, offices, and homes are intended to decrease, thereby reducing the need to use cars and encouraging walking (cf. KULKE 2005, pp. 19f.). However, this only works if people act as planners want them to act: the success of land use change related GHG reduction measures such as MXD depends on their composition and the corresponding consumer behavior. Thus, it is important to study how consumer perceive and use a MXD in order to find out:

In general, is the MXD-concept an appropriate strategy to sustainably reduce VMT and thereby GHG emissions even considering human special needs and actions?

Research question

Present research attempts to address this more general question by employing a case study design. Since according to the National Household Travel Survey (NHTS) 2001-2 shopping contributes 45% of all daily shopping trips (BTS 2009) and since shopping travel is the most likely form of travel to be influenced by mixing land uses, shopping travel behavior has been selected as the focus of this study. As a specific type, grocery shopping trips are analyzed since they are frequent type of shopping travel. Additionally, they are more likely to be influenced by spatial variables as shoppers are more flexible regarding the store they shop at, than regarding their workplace, e.g. The site selected for this research provides the chance to analyze a very special case: at "Park Place" in Irvine, California consumers are offered the opportunity to chain trips or do multipurpose shopping, however, the shopping center of this MXD is anchored by a health food store. Considering the store's special product range and target group, consumers might be less likely to chain trips as they only come for this store and its products. This fact is not only true of this case, MXD often rely on specialty since retailers in MXD's have "[…] to be able to support higher per square foot lease rates […]". Consequently "[…] to support store operations these stores have to attract people from far away […]" (DESHAZO 06-26-2009). Accordingly, the more specific research question of this paper is:

Is specialty retail likely to offset a MXD's VMT reduction goal, i.e., is the mix of a MXD with specialty retail "healthy"?

Definitions of terms used

Present research attempts to find out whether *shopping trips*, i.e., the distance and mode of transportation used to get from an origin to a shopping destination, associated with health food retail located in a MXD can be sustainable. *Sustainability* in terms of low emission mobility or traffic can be achieved in three ways: first, by lowering trip distances, second by increasing the share of non-motorized modes used, and third, by raising the proportion of linked activities (cf. PÄTZOLD 2009, p. 5). This research assumes that shopping travel depends primarily on the *type of products* purchased at a store. *Convenience goods* are low-priced standardized goods that do not vary much in quality. *Specialty goods* are products in low demand and supply for which to get consumers are willing to do a special purchasing effort, in terms of money or time, e.g. (cf. HOLTON 1958, pp. 53-56). They include *health food* and *organic products*. The latter is usually produced with a commitment to specific sustainability guidelines while the former also caters for special diets and includes other products for maintaining or improving health as well, such as vitamins or supplements (cf. HUGHNER *et al*. 2007, pp. 3, 8f., CRANE, F. 1994, p. 54).

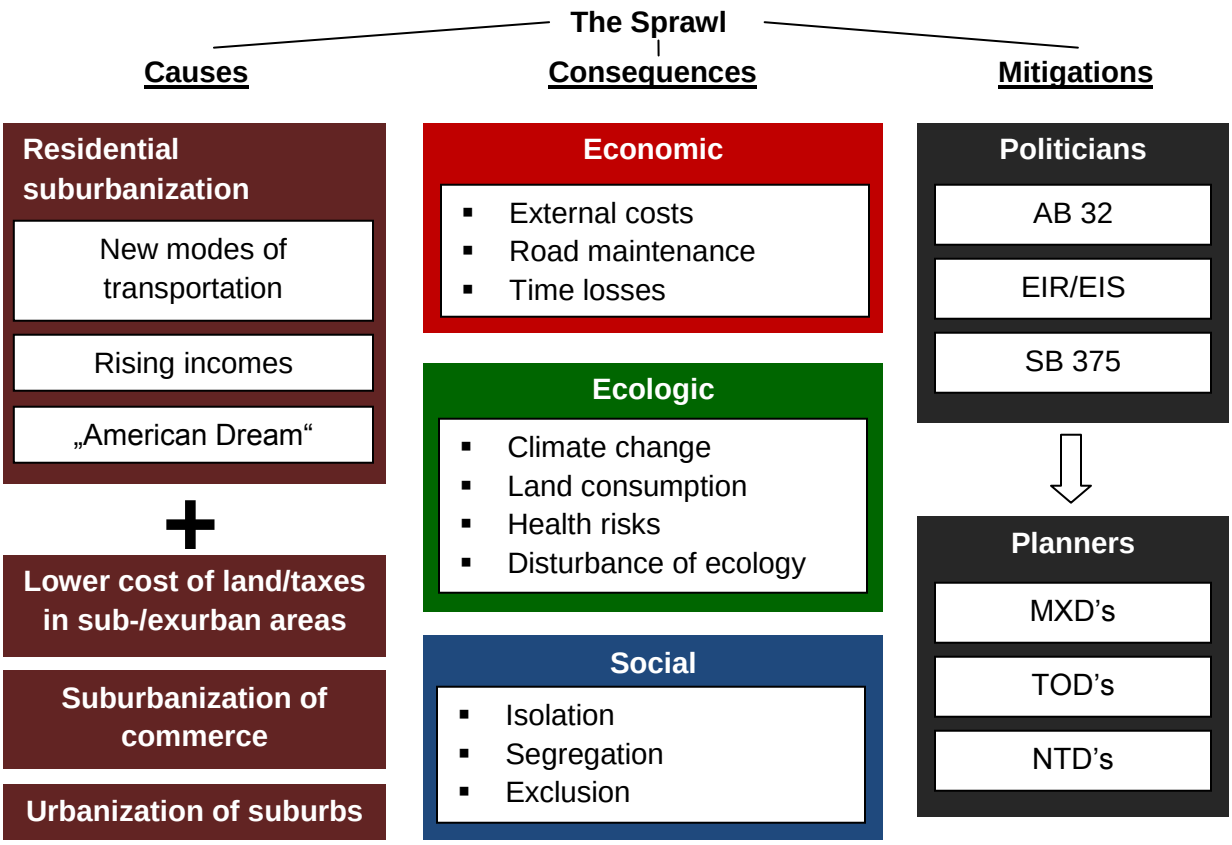
Composition of the paper

This paper is structured as follows: subsequent to the introduction, the general background of the study, the urban sprawl will be outlined. This is followed by a description of MXDs and health food retail. After that central theories will be discussed alongside with some important studies, yielding the main hypotheses. Methodology to test these will be described, followed by the results of the analysis and a discussion of results and recommendations.

2 General background of the study: The urban sprawl

The *urban sprawl* causes many severe problems that are addressed by the state and planners as well (cf. Figure 1). This is mainly due to the separation of land uses that is aggravated by the advent of the automobile. Increasing *suburbanization*, triggered by rising income and mobility, and the Athens Charter that fostered the land use separation have resulted in sprawling cities beyond whose official limits individuals try to live their convenient "American Dream" (cf. KNOX & MCCARTHY 2005 pp. 116ff., HEINEBERG 2006, pp. 121f.; JACOBS 1993, pp. 23-37; RUBIN 2009; CLIO-ONLINE 2009, HESSE 1996, p. 10, TEAFORD 2008, pp. 17f., also cf. HELDT 2010, pp. 5-7).

Figure 1: The sprawl: its causes, its consequences and mitigation measures



Source: own design, see text

But sprawl is not *sustainable* in economic, ecologic, or social terms. Land consumption alongside with increasing motorized traffic causes *health problems*, spurs the *climate change*, and leads to *disparities* between people with and without a car, between the rich and the poor, and the cities and suburbs, altogether likely creating as much inconvenience as convenience (cf. BODENSCHATZ & SCHÖNIG 2005, pp. 72ff.; TEAFORD 2008, pp. 188ff.; HESSE 1996, p. 17). Accordingly, several *legislations* and *measures* have been developed to fight sprawl, most notably California's SB 375 and the concepts of transit-oriented and mixed use development introduced by members of the new *anti-sprawl movement* (BODENSCHATZ & SCHÖNIG 2005, pp. 63ff., 118ff., 139-143). In addition, a considerable change has occurred in the retail industry, especially regarding daily goods. Due to changes at the supply and demand side of the retail market, ever larger stores occupy locations at intersections while cities have been drained off their grocery stores (cf. KULKE 2005, p. 9-24., KRELLER 2000, pp. 22f., AGERGARD *et al.* 1970, pp. 57ff., LANGE 1973, pp. 22ff.)

However, smaller specialty retail concepts, such as health food stores have begun to make use of these gaps (cf. Chapter 3). To understand whether health food stores with their assumed large patches suit mixed use development as the core concept for new urbanism developments in general, MXD and health food retail will be outlined in more detail in the following.

3 Specific background of the study: MXDs and health food retail

This section gives an introduction to the concept of mixed use development in general. In Chapter 6 these aspects are applied to a specific MXD in Irvine, CA. In addition health food retail as a type of grocery stores that has grown considerably over the past years will be discussed.

3.1 Mixed use developments

MXDs emerged during the rise of the New Urbanism as one means to create vital livable neighborhoods (cf. Chapter 2.2). The term "*mixed use development*" was coined more than 30 years ago by the Urban Land Institute (ULI):

> *"A 'mixed use development' means a relatively large-scale real estate project characterized by: three or more significant revenue-producing uses (such as retail, office, residential, hotel/motel, and recreation – which in well-planned projects are mutually supporting); significant functional and physical integration of project components (and thus a highly-intensive use of land), including uninterrupted pedestrian connections; and development in conformance with a coherent plan (which frequently stipulates the type and scale of uses, permitted densities and related items)." (*WITHERSPOON et al. *1976, p. 6).*

More exactly the ULI defines mixed use development by at least *three land uses* and a *project size* of more than 500,000 square feet (ca. 46,450 square meters). The uses should be spatially

interconnected by escalators, elevators, and sidewalks in such a way that a *pedestrian network* is formed (WITHERSPOON *et al*. 1976, p. 7), which is especially important as without such a network a mixed use development cannot work efficiently and sustainably. Finally, the project should be planned in the context of a coherent plan, which means all the actors should be involved in the process of the project development and work together to yield the most satisfying result (WITHERSPOON *et al*. 1976, p. 8; SCHWANKE 2003, p. 4). Other projects that do not include all of the criteria, but still involve multiple uses are referred to as "multi use developments" (WITHERSPOON *et al.* 1976 p. 9).

Cities and planners pursue certain *goals* by emphasizing mixed use developments in their General Plans. While the overall goal is improving the welfare of a city's residents, this can be achieved by MXDs in different ways, i.e., bringing living and working closer together and answering anonymity by breaking monofunctionality (WITHERSPOON *et al.* 1976, p. 38f.), reducing the need for the automobile by facilitating walking[1], and supporting transit, thereby implementing the principles of smart growth and sustainable transportation (SCHWANKE, 2003, p. 27; CERVERO 1988, pp. 430-434, also cf. PÄTZOLD 2009, p. 5). However, for every single project the goals are different, depending on the stakeholders' interests. How the objectives are met, and whether a project is going to be successful or fail, strongly depends on the quality of the collaboration of the participants. In Chapter 6 this will be addressed in more depth for the City of Irvine, which has its own objectives to pursue with a partly MXD-driven approach.

Since the invention of MXDs land use mix or diversity has been promoted as reducing automobile use (CERVERO 1988, pp. 443f, CERVERO & KOCKELMAN 1997, pp. 216f.). Recently, however, some scholars have a more critical point of view. They found substantial methodological discrepancies in many of the studies and conclude that the link between urban design and travel behavior is not necessarily causal. Only because there is a specific urban design intended to encourage residents to walk, it may not necessarily persuade residents to change their behavior or it may attract new residents that would walk anyway, calling into question the actual effect of mixing land uses (BOARNET & CRANE, R. 2001, p. 842).[2] While the actual development trend strongly emphasizes land use mix and MXD's are mushrooming, some scholars (e.g., CRANE, R. 1996) doubt the sustainability and cost-effectiveness of this type of development. In fact, the impact of land use changes on travel is very limited. EWING AND CERVERO (2001, p. 111), for example, find elasticities of only 5%. Raising gas taxes is often

[1] how this may work is outlined in the theory part of this study (Chapter 4)
[2] for a more detailed discussion of research on the land-use – transportation interaction with a focus on diversity or land use mix see Chapter 4

seen as more effective to discourage people to use their cars, however, it is unpopular since the public rather likes soft changes they cannot actually feel in their pockets (TRB 2010, pp. 114ff.). The success of MXD also depends on the types of uses to be mixed. Retail is considered as one of the most important uses a MXD should comprise. Shopping centers or single stores are increasingly situated in the center of a mixed use project showing its significant importance for a MXD's success. Retail businesses generate revenues for the owner and help cover the investment costs. Especially comparison retail, i.e. clothing, shoes, electronic entertainment articles, is denominated as "cornerstone land use" and critical to the success of a MXD (SCHWANKE 2003, pp. 56, 61). Still, convenience retail may be the most sustainable form of retail to locate within a MXD because it is more likely that residents of the site or employees may do their weekly shopping spree or emergency shopping there than in a health food store. However, specialty retail can also serve as an attraction for consumers and give the mixed use development identity (SCHWANKE 2003, p. 63). Specialty retailers are often welcome in mixed use projects as these only provide small store sizes and have high rents, and only specialty stores can support high rent-per-square-foot leases. This implies that these stores need a large special customer base and accordingly may draw consumers from farther away than a comparison or convenience store would (DESHAZO 06-26-2009). Health food retail is considered here as one kind of specialty retail and is to be outlined next.

3.2 Health food retail

As the name suggests, *health food stores* provide healthy food and other items that are health-related such as vitamins, supplements, and similar products (cf. Chapter 1). Health food retail has not been thoroughly studied and discussed in the past and is analyzed here in part as *organic food* on which much more research has been conducted. With increasing food scandals consumers have become increasingly sophisticated and aware of what they eat. Thus, health food in the form of organic products is on the rise since grocery stores offering organic foods are mainly patronized for health reasons and only secondarily due to environmental concerns (SHEPHERD *et al*. 2005, p. 352; HUGHNER *et al*. 2007 pp. 1ff.; WEIß 2005, p. 233). This shows the importance of these store formats and explains the recent growth of long-existing organic and health food retailers as well as more conventional chains that offer organic foods e.g. "Trader Joe's", "Mother's Market", or "Henry's Farmers Market"[3]. "Whole Foods", for example, is growing

[3] Mother's Market founded in 1978 has opened two other stores in 1984 and 1996; in recent years three more stores have been opened within only 10 years (MOTHER'S MARKET 12-08-2009); Henry's Farmers Market opened 16 stores within only 3 years and has grown from 29 to 45 stores (SUPERMARKET NEWS 06-21-2007, HENRY'S FARMERS MARKET n.d.)

at an annual rate of 20% (WEITZ & WHITFIELD 2005, p. 65). In Europe, this trend has been even stronger and organic stores and supermarkets have mushroomed in every major city. However, the market in Europe seems to saturate as the market share is stagnating and the first outlets have been closed due to low rentability (LEUSCHNER 2010, p. 25).

Organic foods are not bought by all consumers at the same frequency. They can be distinguished in those that buy such groceries on a regular basis (regular consumers = "RCs") and those that only occasionally buy fresh organic produce or similar items (occasional consumers = "OCs") (HUGHNER *et al*., pp. 4, 11f.; CRANE, F. 1994, p. 54). While OCs primarily come for more egoistic health reasons, RCs are just as motivated by altruistic environmental concerns (HUGHNER *et al*. 2007, p. 8) which may result in different travel patterns, as RCs may travel shorter distances than OCs (cf. Chapters 4 and 5). Considering the sociodemographics of organic food consumers, studies found that they are usually female and older and associate eating organic with a certain lifestyle and ideology (HUGHNER *et al*. 2007, pp. 2f.).

Mixed use developments as a form of new urbanism design are intended to bring locations of daily activities closer together thereby reducing distances, encouraging people to walk or cycle, and creating vitality. However, the fulfillment of a MXD's goal to reduce traffic by a mix of land uses is seen as critical by scholars. If specialty retail is situated within a MXD this may cause a counter effect to the traffic reduction goals as specialty retail usually has larger catchment areas than other retail (DESHAZO 06-26-2009). In the case of health food retail and organic products this may actually be true as most consumers are concerned about their health rather than the environment making them less distance-sensitive. The theoretical explanation of people's reaction to such a configuration in terms of shopping travel behavior is addressed in the next chapter.

4 Theory

In the following an approach will be developed to explain what travel behavior can be expected from consumers traveling to a mixed use development in general and to a mixed use centered health food market in particular.

4.1 Development of the theoretical approach

Several scholars showed that among the 5 dimensions of the built environment or land use (the 5 Ds: density, diversity, design, distance to transit and destination accessibility) *diversity* is an important criteria to consider when intending to explain travel behavior and reducing traffic (CERVERO 1988, CERVERO 1996, CERVERO & KOCKELMAN 1997). However other studies found

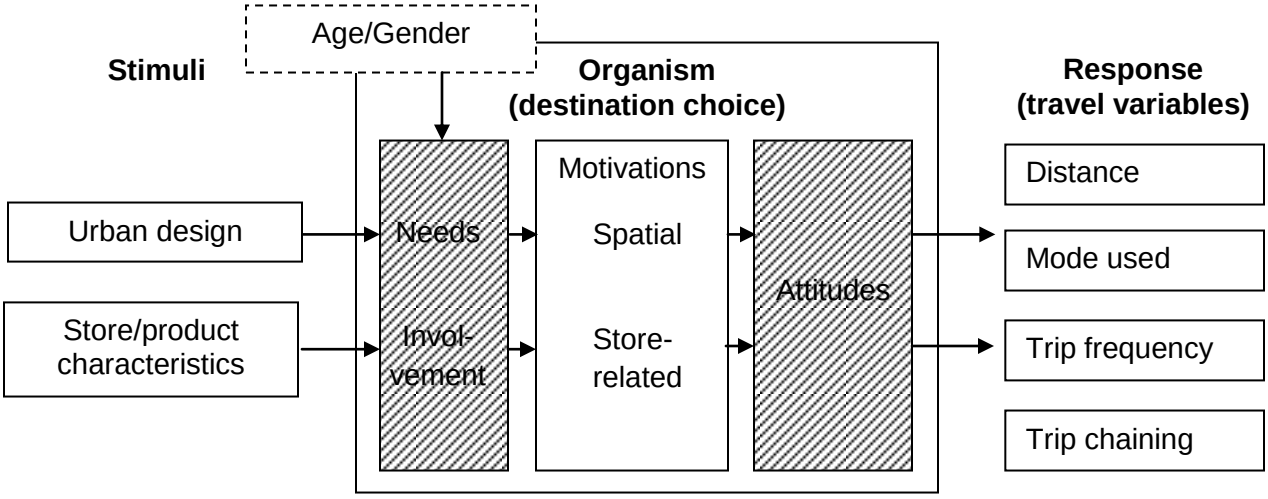
that the effect of diversity on travel behavior is only limited or not clear (BADOE, & MILLER 2001, p. 842, EWING & CERVERO 2001, p. 111). Accordingly additional aspects are to consider when explaining travel behavior. These are *trip-chaining* (cf., e.g., OSTER 1978, MAAT & TIMMERMANS 2006, FRANK *et al*. 2008), *activity spaces* (BULIUNG & KANAROGLOU 2006, FAN & KHATTAK 2008, ARENTZE & TIMMERMANS 2005), and *attitudes* (e.g., KITAMURA *et al.* 1997). As to the study area and perspective of the study most researchers applied a home-based design, only CERVERO (1988) analyzed work places.[4] A recent outstanding study argues theoretically that the built environment is often found to have a limited effect on travel behavior and consider an activity-based approach as more suitable (MAAT *et al.* 2005). Thus the authors of this study explain travel behavior by the utility a consumer derives from the activity itself. Travel is a result of the utility of participating in an activity and disutility from travel (MAAT *et al*. 2005, pp. 37-41). For example, if a consumer prefers a specific store or special products, or likes to purchase at the lowest possible prices, he is willing to exchange extra-distance for additional utility. This shows that the *psychology* consumers needs also to be considered since they do not only react, they rather act. Accordingly the perspective taken here is the consumer and his activity, the so-called *activity-based approach*, or as HANDY puts it: "[...] the demand for travel is derived from the demand for activities […]" (HANDY 2005, p. 11, also cf. HANDY 1996a, pp. 160f.).

"Shopping travel [in particular] is a result of short-term consumer decisions on shopping destination, mode, route and trip-chaining." (MARTIN 2006, pp. 19f.). Accordingly, in this paper, shopping travel behavior is dealt with as a combination of two main decision processes: *destination choice* and *mode choice*. Destination choice is associated with the buying decision of a consumer hence HOWARD & SHETH's (1969, pp. 31-36) *theory of buyer behavior* is the basis for the model which attempts to explain consumers destination choice.

[4] for a thorough discussion of these studies refer to HELDT 2010, pp. 19-23, 108-110 (Table A.1)

This framework has been applied by ZIEHE (1995, pp. 43ff.). For present study her approach was further developed as shown below in Figure 2.

Figure 2: Theoretical framework



Source: own design (shaded variables not measured in this study), based on ZIEHE 1995, p. 43

In general a consumer receives several *stimuli* from his environment but also from himself. These stimuli are processed according to the consumer's *needs* and *involvement* with an activity which result in *motivations* and *attitudes* in turn. The alternative destinations are evaluated on the extent to which they meet these attitudes. *Distance*, *mode*, *trip frequency* and *trip-chaining* are parts of the travel behavior which results from destination choice.

4.2 Theories explaining travel behavior

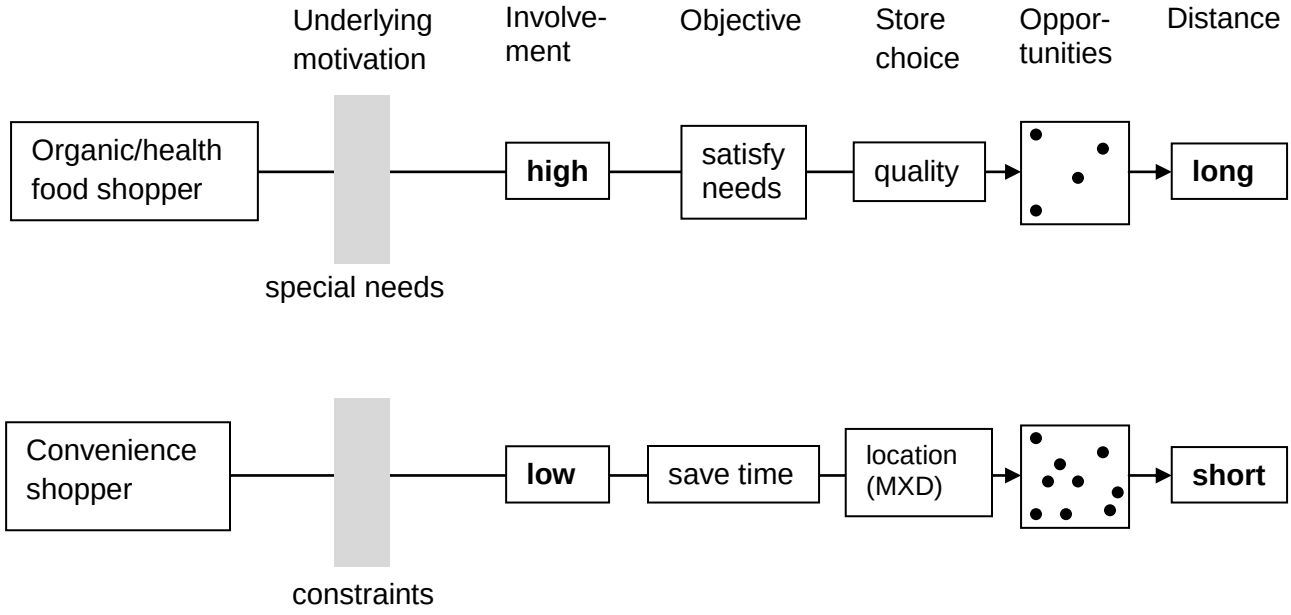
Two basic threads of theories can be developed from this framework to yield the final travel patterns to be expected from mixed use development and health food retail. The first theory suggests that *built environment* variables have a considerable impact on travel behavior. According to CHRISTALLER (1933, in KULKE 2004, pp. 131-135) and LANGE (1973, p. 70) MXDs as central places may attract consumers by offering them the opportunity to perform a variety of purchases and activities in close proximity to each other. Hence mixed use saves consumers resources which they acknowledge as they are restricted by several constraints, particularly time. This implies that destination choice may be mainly motivated by built-environment related factors such as proximity of facilities to each other. As a consequence resulting trips to a mixed use development are assumed to be chained and in total shorter than several trips to different activites.[5]

[5] for a further descirption of theories used refer to Table A in the appendix and to HELDT 2009, pp. 29-37

The other theory based on ideas by HOLTON (1958) assumes that travel behavior is rather determined by *store-related factors*, in particular the availability of certain types of products. Holton argues that **"**specialty goods are goods "[…] on which an insignificant group of buyers characteristically insist and which therefore require a special purchasing effort on the part of these buyers.", thus it is the necessity resulting from a limited market demand and therefore supply which makes specialty goods "special" for consumers (HOLTON 1958, p. 56). Accordingly resulting trips to a specialty goods store in a mixed use development are more likely to be unchained and in total longer than trips that are not related to special products and not related to a mixed use development.[6]

Figure 3 sums these thoughts up: a convenience shopper has constrained resources, thus his intention is to save resources. No matter the type of store, the closest destination is patronized. *Specialty foods shoppers* on the contrary are highly involved when they purchase their special or organic food. Their motivation is to satisfy their special needs, like a certain diet, e.g. Thus *quality* of products matters more than the *location* of the store. Consumers are willing to travel long distances and as such stores are on low distribution they actually have to travel far.

Figure 3: Destination choice and travel patterns for different types of grocery shopping



Source: own design

[6] another approach used by many scholars to describe consumer behavior ist o categorize different types of shoppers, cf. HELDT 2010, pp. 37-40 for a more thorough review of these theories

4.3 Literature review

In the following some studies are reviewed to further evaluate the theoretical framework and the assumptions.

One of the most important studies was conducted by MARTIN (2006) in Berlin, Germany. He surveyed over 1,700 people to find out whether the compact city („Stadt der kurzen Wege“) is a successful planning paradigm considering that shoppers today do not necessarily patronize their closest stores. One of his findings is that while on average the analyzed neighborhoods have a nearest center capture rate of 64% for grocery shopping, this number is 88% for mixed neighborhoods. Yet, consumers that link activities do not generate significantly lower distances traveled as savings achieved by trip-chaining are compensated by higher shopping frequencies and car use (MARTIN 2006, pp. 145f., 224). Consequently, Martin’s study calls the shopping traffic reducing ability of mixing land uses into question.

In another recent study, researchers around JOH (2008) attempted to account for attitudes in their model. In a South Bay, California comparison case study the authors applied regression analysis, controlling for socioeconomic and attitudinal variables to compare mixed use centers with auto-oriented corridors. They found that mixed-use centers had a significantly higher share of walking trips, yet driving trips did not prove to be considerably different. Still, some of the neighborhoods did not have as high a walking share as expected which the authors attribute to urban design features, e.g., a Honda plant that is discouraging, and a pedestrian oriented design which encourages walking. (JOH *et al*. 2008, pp. 88f.). This study’s originality lies in its acknowledgement of locational differences to explain unexpected variations in the models’ results and like Martin’s study doubts the MXD’s traffic reduction ability. However, they have also shown that mixing land uses encourages walking, thereby probably making such neighborhoods more livable and vital, however not reducing motorized traffic.

In their 2001 study, HANDY and CLIFTON attempted to find out whether locating shops closer to homes is an efficient means to reduce VMT. In analyzing over 1,300 Austin, Texas respondents‘ answers and conducting focus groups they found that people still rate the proximity of the store to their homes as important as quality and selection. Consequently, one third of respondents name the closest store as their usual one and this is even more prevalent for more traditional neighborhoods (HANDY & CLIFTON 2001, pp. 328ff.). While shoppers face a tradeoff between distance and store attractiveness, a considerable proportion traveled farther than they would have had to, presumably in order to gain additional utility (HANDY & CLIFTON 2001, pp. 331ff.). One reason for that was to patronize Whole Foods, a natural foods supermarket which people

from the edge of Austin, i.e., 9-15 miles away, patronized every six weeks (WEIß 2005, p. 51). The authors also found that most people do not walk to stores for shopping purposes which they attribute to long distances, carrying goods, poor urban design, barriers, and lacking pedestrian friendliness (HANDY & CLIFTON 2001, pp. 335ff.). The major achievement of this study is the notion that differences of travel behavior among neighborhoods may not be only due to their design but should rather be attributed to self-selection, i.e., people behave the way they do in different neighborhoods because they chose to do so (HANDY & CLIFTON 2001, p. 341, also cf. HOLZ-RAU 1999, pp. 70ff.). In other words, putting the same respondents in a different urban design may not yield any significant change in behavior. Handy and Clifton conclude in finding that although bringing shops closer to home does not lead to a substantial reduction in VMT, it still makes a neighborhood more livable (HANDY & CLIFTON 2001, pp. 344f.).

WEIß, in her 2005 study, dealt with the question of to what extent is the endowment of neighborhoods with environmentally friendly grocery stores important for the environmental impacts of grocery shopping. Surveying 324 individuals in 6 neighborhoods in Berlin, Germany she found that especially individuals that consider the purchase of environmentally friendly products as very important are not willing to travel long distances. However, health conscious individuals in special occasions traveled far for special products, e.g., for dietary reasons if they have allergies or are vegetarian. Yet, the motivations for this behavior are not related to protecting the environment. Nevertheless, in total people that prefer to buy environmentally friendly products are sensitive to distance while price conscious shoppers are often willing to travel far (WEIß 2005, p. 248).

As a whole, the mentioned studies demonstrate that the built environment only has a limited effect on travel behavior, diversity does not lead to significantly less motorized travel, however it encourages more walking, which may also be due to a design suited for pedestrians. Store-related characteristics, however, seem to have a considerable effect on distances traveled. For low prices and special products people seem to be willing to travel far, yet, products that are environmentally friendly are bought at a shorter distance.

5 Hypotheses and methodology

As follows several hypotheses are outlined in order to structure the following analysis. Subsequently research methods to test the assumptions are described.

5.1 Hypotheses

The empirical literature review showed that particularly the *type of product* seems to have a considerable impact on travel behavior (Chapter 3). Consequently, it is important to compare a specialty store (denominated as "MMI" - "Mother's Market Irvine") with other stores ("OTH") which are not primarily special, and prove whether there actually are differences in consumers' motivations and resulting travel patterns. Literature also showed that motivations for buying organic food may differ depending on the frequency it is purchased (HUGHNER *et al*. 2007, pp. 3-12). Therefore, a second comparison will be conducted for regular consumers of specialty stores (RCs) and occasional consumers of specialty stores (OCs) (cf. Chapter 5.4). Table 1 summarizes the assumed relations of the tested variables. Please refer to this table while considering the hypotheses.

Table 1: Assumed strengths of consumer behavior attributes tested

Importance of Proximity

	MMI	OTH
RCs	++	N/A
OCs	+	+++

Importance of quality/ organics/specialty

	MMI	OTH
RCs	++	N/A
OCs	+++	+

Distance traveled

	MMI	OTH
RCs	++	N/A
OCs	+++	+

the number of "+" shows the assumed strength of the criterion

Source: own design

In particular the following main hypotheses have been developed ordered into the following categories: motivations, distances, distances and motivations, trip-chaining and mode choice.[7]

Motivations:

H1: Health food stores are specialty stores: they are patronized by consumers to buy special products they cannot get anywhere else

H2: Specialty shoppers (RCs) are motivated by the quality of products and the availability of special products like organics while other shoppers (OCs), and especially convenience shoppers are motivated by a convenient location.

[7] consider HELDT 2010, pp. 44-48, for a review of the development of these hypotheses

Distances:

H3: Specialty shoppers (RCs) are willing to travel longer distances to a health food store than other shoppers, and they actually do so. OCs travel even longer distances to a specialty store.

Distances and motivations:

H4: Distance traveled to a conventional grocery store is negatively correlated with the importance of proximity, and positively correlated with importance of prices or quality or availability of organics.

Trip-chaining and mode choice:

H5: Specialty shoppers (RCs) tend to link less activities with shopping than convenience shoppers (OCs), thus they come more often from their homes than from any other activity. This does not differ for occasional and regular consumers when shopping at the specialty store. Car mode share of regular consumers is smaller than that of occasional consumers.

To what extent do RCs shopping at MMI link activities as compared to OCs shopping there?

5.2 Research design

These hypotheses are analyzed using a case study research design[8] composed of *quantitative* and *qualitative* research methods.[9] As *study site* a health food store at Park Place in Irvine, CA has been chosen as it can be considered a MXD and provides the opportunity to study the interaction of a mixed use development and a health food market. The main research instrument is a point of sale (POS) *intercept survey* conducted in front of a mixed use centered health food market in Irvine, CA, in November 2009. The questionnaire (cf. Figure A in the appendix) comprises questions on the frequency of grocery shopping, the destination of grocery shopping when consumers bought their groceries more often there than in the analyzed health food market and open-ended (likert-scale) and closed questions on the motivations for patronizing these destinations. Consumers were also asked for the mode of transportation they used. Case study data was gathered by on-site visits and a review of documents and has been complemented by *expert interviews* (cf. Figures B and C in the appendix) with a planner from the City of Irvine and a representative of Mother's Market.

The geographic data has been geocoded and *mapped* and *network distances* were calculated using the ArcGIS Network Analyst. Using network distance instead of straight-line distance provides for higher accuracy of the research (cf. HANDY *et al.* 1998, p. 25; LIU & ZHU 2004, pp.

[8] refer to YIN 2008, pp. 48-53 for a discussion of case study research designs
[9] refer to HELDT 2010, pp. 49-50 for a thorough description of the methodology

109f.). Resulting distances were compared for RCs and OCs using *statistical tests*, in particular the Mann-Whitney test and the Wilcoxon test as well as simple descriptive statistics. *Correlations* between motivations and distances were analyzed with the help of Kendall's tau-b. The mentioned procedures account for the skewness and deterioration of the data which makes parametric tests like the t-test and Pearson's correlation coefficient less reliable (FIELD 2009, pp. 181f., 540-558). *Quotes* from open-ended questions and expert interviews complement the quantitative data.

6 The analysis

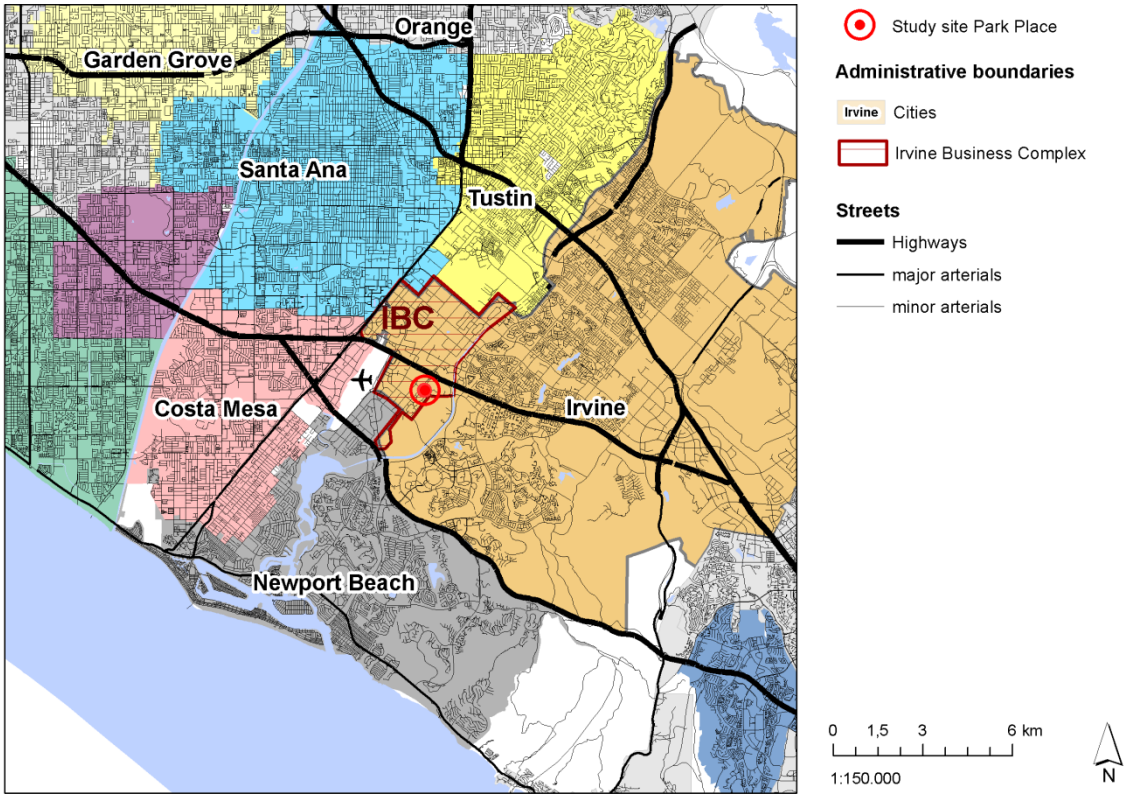
The analysis of the case consists of two parts. First, the study site and contextual information will be described, second, the hypotheses will be tested. Finally, the results are summarized.

6.1 The study site

The City of Irvine was chosen as the place to conduct the study as Irvine features a typically suburban design but recently intends to build denser and more urban. In this context mixed use developments play an important role as instruments to achieve the goals of the so-called IBC Vision plan. The IBC, or Irvine Business Complex, had been an industrial park with many manufacturing facilities and has transformed to an edge city focusing on services industries which employ about 83,000 people. The city wants to further develop this area towards an urban, mixed city and build much more housing than is available now (CITY OF IRVINE n.d.$_{a.}$, IRVINE CHAMBER 2009, p. 1, CITY OF IRVINE n.d.$_{b}$).

The study site, Park Place Irvine, has been chosen among several sites as it fulfills most of the criteria mentioned in Chapter 3. Even more important, however, is the specific combination of a mixed use design and specialty retail which is unique. Park Place once was the headquarters of Fluor Co., hence its convenient location at the freeway and the major arterial Jamboree Road (Figure 4, next page). In 1985 Fluor sold the property to Trammell Crowe, a developer company, who has built a corner of retail as well as additional office towers until 2004. This was in accordance with the mixed use master plan from 1987. In 2004 Maguire Properties acquired the site and one year later the first luxury high-rise residential towers in Orange County, the so-called "Marquee" opened (IBRAHIM 06-12-2000, STRICKLAND 06-22-1999, CITY OF IRVINE 12-09-2009, COKER 08-12-2009, MUELLER 07-12-2010).

Figure 4: Location of the study site in Orange County



Source: own map, data sources: CITY OF IRVINE 2009, U.S. CENSUS BUREAU 2009/10

Today Park Place mainly consists of offices and parking lots and garages (cf. Figure 5, next page). Retail and residential uses make up only a low proportion of the total project size. Additionally these uses are not well interconnected and rather work like islands, separated by streets parking lots, walls, gates and buildings. Accordingly the site does not the meet the design criteria for mixed use developments. As the missing of a pedestrian network shows the design is rather automobile-oriented than pedestrian-oriented.

The retail corner, which occupies about 7,800 m² of stores and 3,800 m² of restaurants (2% of the total site area, cf. Figure 5), mainly consists of specialty stores and services (CITY OF IRVINE 2005). It features a health food supermarket, a sporting goods store, an optometry, a jewelry, quick, casual and fine dining, a wine bar and several beauty services (IRVINE CHAMBER 2010). Other product groups, such as drugs or newspapers are missing. As this composition shows the retail mix is not very complementary and people may only come to the development for just one shopping purpose.

Figure 5: Park Place – composition of land uses

Sources: photo: Google Earth 2010, GIS data: CITY OF IRVINE 2009, Land use data: id. 2005

The health food store itself covers about 929 m² of floor space and predominantly offers food for consumers who have special diets, and organic produce and beauty items. Their products are intended to maintain or improve one's health. "Mother's Market" is based in Newport Beach and operates six stores in Orange County (MOTHER'S MARKET 12-08-2009, MOTHER'S MARKET 11-26-2009). As the restaurant, the delis, and the juice bar show, retail at Park Place is oriented towards the lunchtime population from the offices. On average the store in Irvine served 1,200 customers per day in 2009 (MOTHER'S MARKET 07-06-2010).

In total Park Place does not seem to be a good example of a mixed use development and the retail mix implies no sustainable travel behavior with linked activities.

6.2 Test of hypotheses

Since the analysis is based on the comparison of regular and occasional consumers of healthy food (RCs and OCs) and therefore on frequency it is necessary to test for the reliability of frequency of shopping as the differentiation criterion. Or put in other words it is a prerequisite to find out whether OCs and RCs really differ in frequency of shopping at the health food store. The U-test shows that both groups do significantly differ in frequency of grocery shopping trips to Mother's Market which confirms the usefulness of a comparison of both groups (HELDT 2010, p. 70f.).

120 consumers took part in the survey which is a relatively good response rate of 35%. The sample represents 5.4% of the total population.[10] Considering grocery shopping frequency shows that 80% of all trips of the surveyed consumers were covered, which yields a total explanation power of the study of 4%.

Out of these consumers 62% were regular ones and 38% OCs (cf. Table B in the appendix).[11] Both groups do not differ with regards to age, however, occasional consumers consist of considerably more female than regular ones. On average regular consumers shop more often for groceries in general and also more often at the health food store than do occasional consumers at other stores. This can be attributed to regular consumers preferring fresh food while other stores are rather patronized in order to perform weekly shopping sprees. Regular consumers also seem to avoid the busiest hours of the day, i.e., lunch time and after work hours, when shopping at Park Place. They rather come in the mornings or evenings which may be due to the high number of products regular consumers may buy as opposed to occasional consumers.

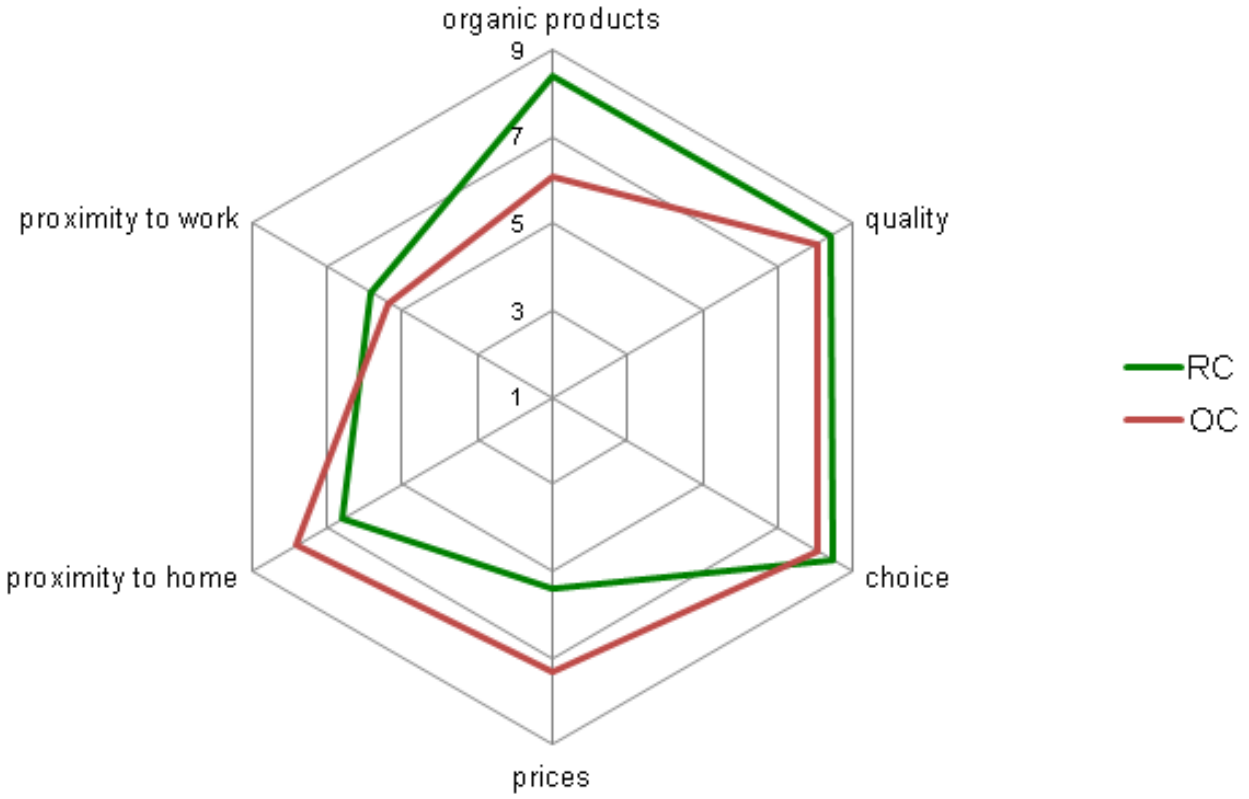
Motivations

Consumers come to the health food store to shop for special or organic products (mentioned by 34% and 39%, respectively) while other stores are preferred because of their location (45%) and lower prices (49%). Special products are of higher importance for occasional consumers than for regular ones, implying the former are less distance-sensitive. An analysis of the given motivation rankings (Figure 6) confirms these findings for organic products and prices. A comparison of the mean ratings also shows that consumers in general consider proximity as more important for their store choice when shopping at a store other than Mother's Market Irvine. However, proximity is of higher relevance for RCs than assumed. One last fact to note is that prices are of high importance for OCs which may result in a willingness to travel long distances that is stronger than predicted. In total H1 cannot be rejected. However, health food stores are also patronized by regular consumers in order to buy organic products which they could get at other stores as well. H2 can be confirmed in that regular consumers buy special and organic products and in that location matters more for occasional consumers, particularly the answers to the open-ended questions support this hypothesis. However, quality does not seem to matter more for RCs and RCs are more concerned about location than assumed.

[10] Mother's Market is patronized by 1,200 customers per day. The store is opened from 8 am to 10 pm, i.e. 14 hours, i.e. 86 customers per hour. The total surveying time was 26 hours, which would equal a population of 2,229 customers. the sample size of 120 divided by 2,229 yields 5.4%.

[11] if consumers traveled to both stores as often, they were asked which store they prefer or at which store they spend more money

Figure 6: Mean ratings of store choice motivation ranks for OCs and RCs



Source: own survey 11/2009

As regular consumers may be willing to travel longer distances to MMI than OCs to other stores, the following section will investigate the distances both groups of consumers traveled to the respective stores.

Distance

Distances derived from the network analyses are compared for RCs and OCs to MMI and OTH and for OCs to MMI and OTH in Tables 2 and 3 on the next page. Results for the more reliable non-paramertric Mann-Whitney-U test and Wilcoxon-test indicate that consumers largely behaved like predicted. The mean distances traveled by regular consumers to Park Place were significantly longer than those traveled by occasional consumers to other stores. Contrary to H3, OCs did not travel significantly farther to MMI than to OTH.

Although distances traveled and grocery shopping frequencies were not correlated in a significant way and shopping frequencies at the preferred store were not significantly higher for

RCs, monthly kilometers traveled[12] differed significantly for OCs and RCs. In sum RCs had much longer shopping trips than OCs per month.

Table 2: Comparison of distances traveled by RCs to MMI and OCs to OTH

	Independent-samples t-test*			Mann-Whitney-U-test		
	N	M	sig., 2-tailed	N	Mdn	sig., 2-tailed
RC	40	4859.06	ns	45	4904.90	0.081
OC	65	4008.63		68	3575.36	

* outliers DISpst > 15,000 excluded

Source: own survey, 11/2009

Table 3: Comparison of distances traveled by OCs to MMI and OTH

	Dependent-samples t-test*			Wilcoxon test		
	N	M	sig., 2-tailed	N	Mdn	sig., 2-tailed
distance to MMI (meters)	58	6230.98	0.096	61	4874.77	ns
distance to OTH (meters)		4258.42			3764.25	

* outliers DISmmi > 15,000 and DISoth > 15,000 excluded

Source: own survey 11/2009

In sum, H3 can only be confirmed for the first part. In the following motivations are analyzed in order to find out which factors may be associated with the observation that regular consumers traveled farther to MMI than OCs did to OTH. However, determining causation is beyond the scope of this research, the following findings are just indicators what may cause the differences in trip lengths.

Distances and motivations

In order to find possible reasons why people travel as they do, several correlation analyses were performed for motivations and distances traveled. However, no significant correlations were found except for two, proximity to home and distance traveled to the preferred store were correlated negatively as predicted. This was true for RCs and OCs as well. Since the predicted positive correlations for organic / quality of products and distance did not turn out to be true, this part of H4 is to reject for the quantitative part of the analysis.

[12] MKT = frequency of trips to preferred store * distance traveled to preferred store (per trip)

Consumers additionally have been assigned to different groups in two ways. First, based on motivations, typical shoppers were identified, second, based on the type of store consumers patronized, consumers have been ordered according to typical shopping destinations. [13] [14]

Tables 4 and 5 below indicate the composition of RCs and OCs according to shopper type and shopping destinations for OCs. Additionally for each subgroup the mean distances traveled are shown.

Table 4: Type of shopper and mean distances traveled by RCs and OCs to preferred stores

			Type of shopper			
		N	Convenience	Quality/organic	Traditional	Economic
RC	%	46	4%	83%	11%	2%
	Mean (DISpst)*	40	N/A	5324.16	3853.23	N/A
OC	%	74	41%	26%	8%	26%
	Mean (DISpst)*	65	3353.10	4127.21	2319.86	5276.22
total	%	120	27%	48%	9%	17%
	Mean (DISpst)*	105	3129.98	4908.89	3086.54	5211.20

* DISpst > 15,000 excluded

Source: own survey 11/2009, N/A for proportions < 5%

Table 5: OCs by store type and corresponding distances traveled to preferred stores

		Type of store				
	N	Convenience Store	Mother's Market	Specialty Store	Supermarket	Trader Joe's
%	74	24%	7%	19%	9%	41%
Mean (DISpst)*	65	2021.74	4793.33	3772.44	5718.37	4563.78

* DISpst > 15000 excluded

Source: own survey 11/2009

As expected, regular consumers mainly consist of organic/quality or in general specialty shoppers who travel considerably long distances. On the contrary, occasional consumers do not

[13] if ratings for any of the proximity variables were the highest: 1 = convenience shoppers, if quality or organic ratings were higher than proximity: 2 = organic/quality shopper, if both were equal, answers to open-ended questions were used as complementing criterion, if both were still equally mentioned: 3 = traditional shopper; and if prices were most important: 5 = economic shopper, this categorization has been tested against the ratings which yielded a good fit

[14] stores have been categorized as follows: Trader Joe's as most visited store among all occasional consumers was assigned an own category (= 5), other stores: 1 = convenience: Ralphs, Albertsons; 3 = specialty markets: 99 Ranch Market, Farmers Markets, Gelson's, Henry's Farmers Market, Whole Foods; 4 = Supermarkets: Bristol Farms, Stater Bros., Costco, Pavilions; a comparison with ratings yielded a good fit; 2 = Mother's Market

only consist of convenience shoppers as expected, rather prices and quality also play an important role. In fact, convenience shoppers travel the shortest ways, while particularly economic shoppers travel as far as quality shoppers. This shows the contradiction between sustainable shopping and egoistic shopping. Table 5 indicates that this is mainly due to Trader Joe's which also offers organic products and is relatively sparsely distributed in space. Contrarily, convenience stores, such as Ralphs or Albertsons are really used in order to travel only short ways.

Qualitative analysis also implies a low distance-sensitivity for shopping trips to MMI. People would "[…] come here even if it'd be farther away […]" (106, OC) and Mother's Market "[…] is out of [their] way, [they] make special efforts to get [there]." (42, RC). Reasons for the willingness to travel long distances are special products such as oil, yoghurt and supplements, vitamins and "[…] things, others don't have.", but also prices (106, 81, OCs). Furthermore consumers chose the store because of other, more individual, reasons and preferences such as the store having a good cook[15] or no smell from a meat or fish counter (88, RC). There was even one consumer (61, RC, the only one from the residential towers "Marquee") who said he moved to Park Place because of the store, which is likely to be exaggerated, but still indicative of the drawing power a specialty store has.

The results above show that occasional consumers (traveling to OTH) in general have a more sustainable spatial shopping behavior than regular consumers. Nevertheless, they also consist of economic shoppers which travel long distances in order to purchase at the lowest possible prices. Qualitative analyses imply that one possible reason for this difference is the availability of special products which make consumers willing to perform a special purchasing effort. They have to travel far as stores carrying their preferred products are on low distribution. This supports HOLTON's thoughts. Another factor at play may be trip-chaining which is to be analyzed next.

Trip-chaining and mode choice

Linking activities is one way to contribute to sustainable traffic (cf. Chapters 1 and 3). Accordingly, it is important to look at where people come from and what they did before shopping. All activities, other than home imply a linkage of shopping with another activity on one tour.

[15] Mother's Market also has a restaurant where many people have dinner or lunch

Table 6 summarizes the proportions of the activities performed before shopping for the trips of regular consumers to MMI and OTH, and for occasional consumers traveling to OTH.

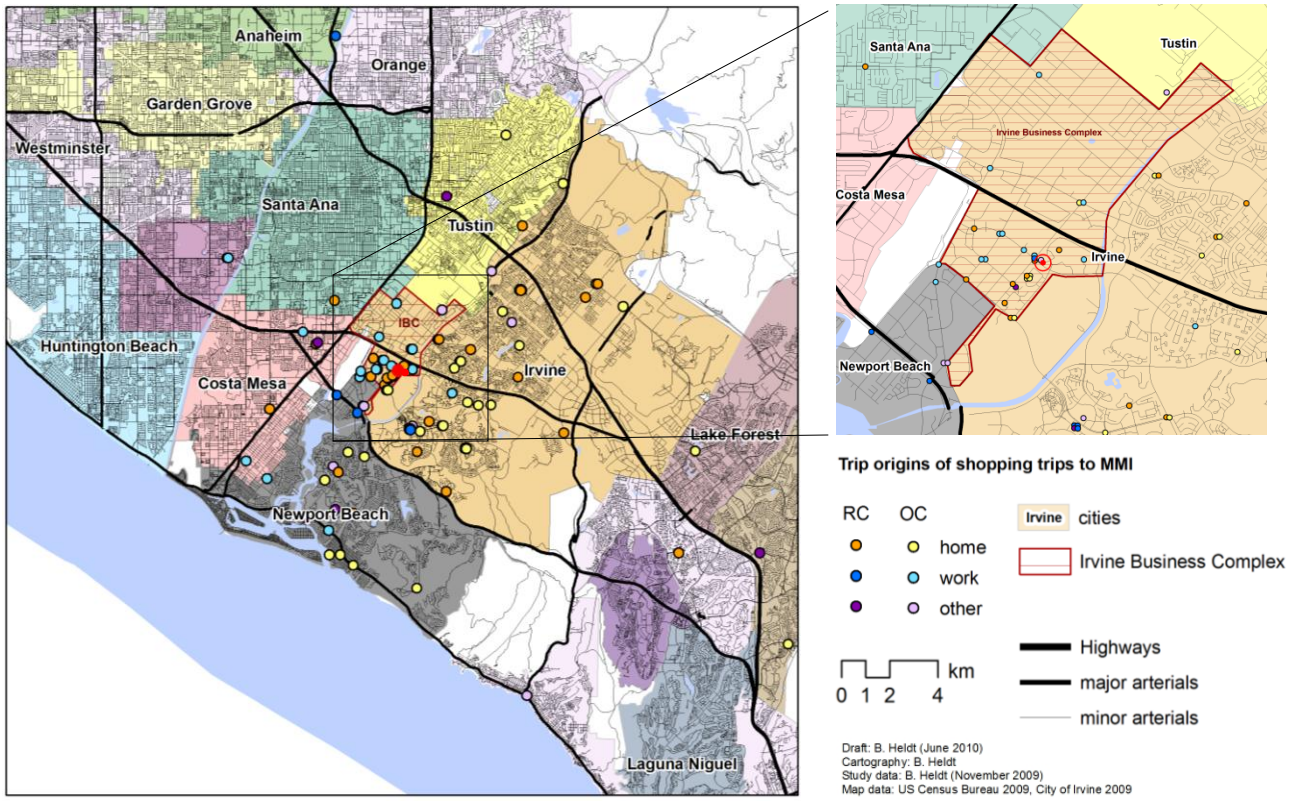
Table 6: Activities before shopping of RCs at MMI, and OCs at OTH and MMI

Type of consumer	Type of store	Activity before shopping trip		
		home	work	other
RC	MMI	65%	22%	13%
OC	OTH	67%	23%	10%
OC	MMI	53%	32%	15%

Source: own survey 11/2009

As can be seen, the distribution for RCs shopping at MMI and OCs shopping at OTH is about the same, i.e., this part of H5 is not supported. Regular consumers come more often from other activities than assumed and OCs more often from home than assumed. If comparing both groups shopping at MMI, it can be drawn from the table that occasional consumers come less often from home implying higher trip-chaining.

Figure 7: Activities performed before shopping at MMI, and their locations



This may be due to the effect that purchases of just a limited amount of goods can be easily done on the way. According to the findings it may be less important for consumers that the store has special products to offer than that the store is conveniently located.

Figure 7 (previous page) shows where occasional and regular consumers came from before their shopping at MMI. It appears that trip-chaining is mostly associated with consumers that have their place of work in the IBC. Particularly occasional consumers use this opportunity, probably because they have less to carry home as they purchase less products.

As reasons for this behavior consumers mentioned that they "often come from running errands, […] have a big car and try to save gasoline" (50, OC).

As a conclusion, specialty may not necessarily imply a special purchasing effort in terms of time, consumers are still aware of resource-saving by trip-chaining. However, still many of the occasional consumers come from home while many of the regular consumers, although shopping for many products, come from work or other locations. While most people come from home and many only come to the MXD because of MMI, trip-chaining potential can be indentified for trips associated with the IBC, and for long trips because of the location at the freeway. When shopping at other stores, occasional consumers linked less activities which may be due to the fact that they buy more products there and live closer to the store.

Mode choice

A third way to design mobility sustainably is a low mode share of cars. For the analysis of the modal split GIS helped to determine how many and which consumers came from within walking distance (1 km).[16] A split by type of consumer shows that of OCs and RCs about the same proportion (14% and 13% respectively) lives within a distance of 1 kilometer. However, 19% of all regular consumers used non-motorized modes while only 10% of occasional consumers did so, confirming this part of Hypothesis 5. This may be due to the higher environmental consciousness of regular consumers (cf. HUGHNER *et al*. 2007, p. 8).

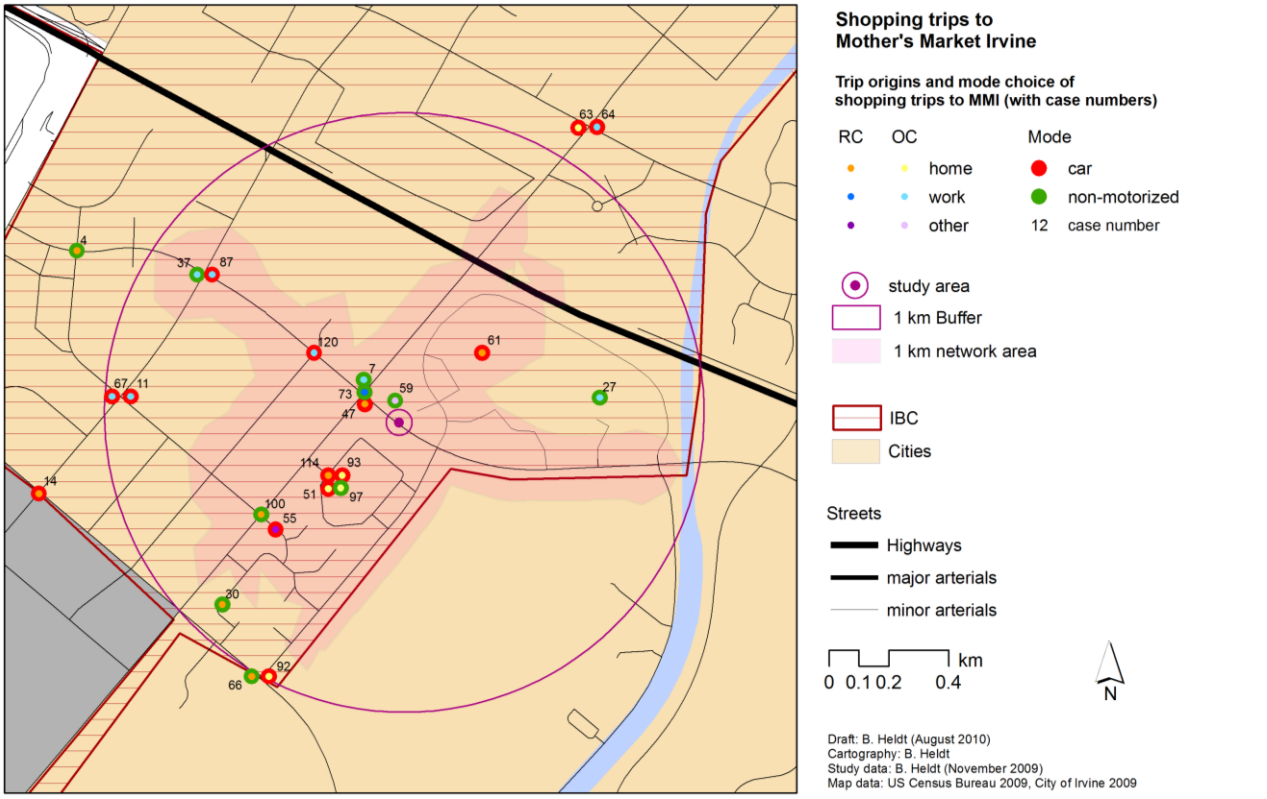
Figure 8 (next page) shows exactly which consumers came from within 1 km network and straight-line distance. Red dots indicate consumers coming by car, green dots represent shoppers who walked or cycled. It appears that consumers did not walk because of the following reasons (cf. Table C in the appendix): they are used to their car and are on their way to/from

[16] American transportation research considers walking distance as ¼ mile (400 meters, cf. KRIZEK 2003, p. 398, e.g.), however, consumers themselves, when asked for whether the distance would allow walking considered distances longer than 400 meters as walkable, and, additionally, cycling is included in the analysis

somewhere or running errands (47, 66, 67, 120), they do not have enough time (11, 51), or because they do not like to carry heavy bags (100, 114). For some consumers roads, traffic, and parking lots make walking inconvenient, and in some cases even dangerous (22, 20, 55). Conversely they did like to walk or cycle because of enjoyment or exercising (27, 37, 97). These results show that people primarily do not walk because they are used to the car and its flexibility. If they walk it is more because of the physical activity than for destination walking. Accordingly, the auto-oriented design does not seem to be so much a reason for consumer's mode share as HANDY's work suggested (cf. HANDY & CLIFTON 2001. pp. 335ff.; HANDY 1996c: p. 144).

Finally the analysis found that public transport does not have a good reputation among the respondents. The service is not frequent enough and the stops are too distant from the activity locations. Therefore public transportation from a consumer's perspective is not a suitable choice for shopping trips (cf. HELDT, p. 89).

Figure 8: Walkability and actual mode of shopping trips to MMI



6.3 Summary of results

The description of the site and its location and structure showed, that Park Place is not a good example of a mixed use development. It consists of a considerable project size and several land uses and can therefore be considered a MXD, according to WITHERSPOON (1976, p. 6). The site is conveniently located in a developing area of Irvine, adjacent to a major intersection. Suiting its history and main uses the MXD is designed for the car and all land uses are accessible by automobile. Park Place seem to be perceived by its single land uses rather than as a whole development. Retail, housing and offices seem to be like islands separated by streets, parking or walls. The retail portion houses a special but not complementary mix. Everyday items like newspapers, flowers or drugs can only be purchased in the health food market and at limited product range. As a conclusion of these facts, travel patterns associated with the health food market were not expected to be sustainable.

Table 7: Assumed and observed strengths of consumer behavior attributes tested

Importance of Proximity

	MMI	OTH
RCs	++	N/A
OCs	+	+++

Importance of quality/ organics/specialty

	MMI	OTH
RCs	++	N/A
OCs	+++ (++)	+

Distance traveled

	MMI	OTH
RCs	++	N/A
OCs	+++ (++)	+

the number of "+" shows the assumed strength of the criterion
red indicates a wrong assumption, black the correct result

Source: own design

Table 7 shows that the assumed differences between RCs and OCs could mainly be confirmed. However, occasional consumers did not prioritize quality, organics or specialty much more as a motivation to go to the health food market than did regular consumers. Occasional consumers predominantly came to get special products while most RCs mentioned organics as the main reason to patronize MMI. Accordingly, the distances traveled by OCs to the health food store are not significantly greater than those traveled by RCs. Trip-chaining may be one reason as occasional consumers that buy fewer products, are more likely to link activities.

As can be seen in Figure 9, most hypotheses could be supported by the results of the analysis. As expected, distances for RCs traveling to MMI were greater than distances traveled by OCs to

OTH. And also as assumed, motivations for RCs traveling to MMI were predominantly associated with organics, while OCs traveled to other stores because of their proximity to their homes. However, one major exception is that quantitatively no associations and therefore no possible reasons could be identified. The importance at which consumers rate quality or the availability of organics is not associated with their distances traveled. Another surprising result is that occasional consumers chained more trips than regular consumers. As shown by the mode choice analysis regular consumers cycled or walked more often than occasional ones. Reasons for that are not associated with the environment, but rather with egoistic aspects, such as physical activity. People did not walk mainly because of being used to the car and its flexibility but also because of a non-pedestrian friendly design.

Motivations:

H1: Health food stores are specialty stores: they are patronized by consumers to buy special products they cannot get anywhere else

H2: Specialty shoppers (RCs) are motivated by the quality of products and the availability of special products like organics while other shoppers (OCs), and especially convenience shoppers are motivated by a convenient location.

Distances:

H3: Specialty shoppers (RCs) are willing to travel longer distances to a health food store than other shoppers, and they actually do so. OCs travel even longer distances to a specialty store.

Distances and motivations:

H4: Distance traveled to a conventional grocery store is negatively correlated with the importance of proximity, and positively correlated with importance of prices or quality or availability of organics.

Mode choice and trip-chaining:

H5: Specialty shoppers (RCs) tend to link less activities with shopping than convenience shoppers (OCs), thus they come more often from their homes than from any other activity. This does not differ for occasional and regular consumers when shopping at the specialty store. Car mode share of regular consumers is smaller than that of occasional consumers.

red indicates parts of the hypotheses that could not be supported

In the last chapter, these results will be discussed and recommendations for the developments will be given. After that some general conclusions will be pointed out.

7 Discussion and conclusion

This research attempted to find out to what extent a health food store located in a mixed use development is associated with sustainable shopping travel patterns. The analysis of POS intercept surveys and interviews shows that in conclusion the mix of a MXD with specialty retail in general and health food retail in particular may not be healthy in terms of sustainable travel patterns. Rather, grocery shopping travel distances for those kinds of stores tend to be long and shoppers often do not use other parts of the development. This seems to corroborate in part MARTIN's (2006, p. 224) findings that mixed use does not help decrease trip distances and HOLTON's (1958, p. 56) assumptions that specialty shoppers make a special purchasing effort. This effort is reflected in greater trip lengths of shopping trips that are intended to buy specialty groceries as compared to conventional groceries, which coincides with CHRISTALLER's theory of central places. Furthermore, in accordance with the study of WEIß (2005, p. 248) is the finding that organic shoppers travel far distances for health, but in general health food shopping does not seem to be strongly related to environmentally friendly behavior. Although distances traveled differ for regular and occasional health food shoppers, no reasons for these differences could be found. This implies that consumers behave differently mainly due to the distinct availability of convenience and specialty stores which corroborates findings from HOLZ-RAU & KUTTER (1995, pp. 53f.) and HOLZ-RAU (1999, pp. 36-42) that differing spatial consumer behavior can be explained by the spatial distribution of stores rather than the land use pattern in general (also cf. KAGERMEIER 1991, p. 97f.). Nevertheless, a health food store's impacts on traffic may be moderated by a mixed use setting. In general mixed use developments, if designed appropriately, may be sustainable and capable to fulfill their traffic reduction goal. Accordingly, if analyzing a mixed use centered convenience store, the result might be that distances caused by this store were shorter than distances caused by non-mixed use settings. This would rather contradict Martin's results and support the German idea of a compact, mixed city and is thus desirable for future research (see below).

What needs to be addressed by planners to more efficiently help decrease green house gases emitted by the traffic generated by specialty shopping trips, is linking of activities. Opportunities must be created to link activities and infrastructure must be provided to enable and encourage consumers to realize these opportunities. As Park Place shows, it may be helpful that a mixed use development is owned and developed by one institution to ensure a coherent plan that features mutually supporting uses and infrastructure. Governmental institutions need to advise developers to encourage sustainable designs that are not only car-oriented and to reduce barriers external to the development, in particular infrastructure for pedestrians should be built

and public transport improved to ensure better local external accessibility of a MXD which would increase the walking share (cf. HANDY 1996c, p. 144). One other recommendation is to reduce car speed throughout a development which would make other modes more competitive (MAAT *et al*. 2005, pp. 39ff.). Developers and the community development together should encourage retailers to work collectively and establish one management for the retail portion of the MXD in order to create a complementary retail mix that enables consumers to buy most things in that one location and substitute for other shopping trips. This is especially important when considering specialty shopping as trips needed to obtain basic goods that are not available, or not available at a reasonable price in the specialty store, could be prevented. Therefore it is not important to only locate stores near residential areas, as HANDY & CLIFTON found, but rather to create a mix of retail opportunities that are well accessible but still mixed with other uses as compared to monofunctional shopping centers. To summarize, in general, the traffic-related sustainability of mixed use developments can be enhanced twofold. First, distances need to be decreased by a better internal land use balance and, second, modal split can be addressed by providing good public transportation for consumers to get to the MXD while consumers walk to get from one location to another within the development.

This study has several limitations to provide approaches and ideas for further research. First and foremost, consumers did not have to rate the importance of the motivation of the availability of special products which in some cases made drawing general conclusions difficult. Additionally, regular consumers could be asked for other stores they patronize to get a complete picture of internal and external spatial consumer behavior of health food store shoppers, which would make the results more accurate. This should be complemented by having consumers also rate the importance of store choice for the non-preferred store in order to compare both ratings. Considering the research design, it would be very interesting to do a comparison case study of either one MXD with a health food store and one without, or one health food store within a MXD and one located in a conventional shopping center setting. What is more, also a convenience store located in a mixed use setting and a convenience store located elsewhere could be compared in order to control for the store and find out what influence mixed use really has. Additionally, other kinds of specialty stores could be investigated. These designs would give a more detailed insight into the effects among MXDs, specialty retail, and consumer behavior and that could be complemented by a more qualitative design to gain a better understanding of consumers' motivations. Lastly studies should also apply other more realistic travel impedances such as time traveled derived from car speeds.

Although Park Place may not be a true mixed use development, it was just one of the first master plans in California that featured mixed uses and "[…] when it was first approved in 1989, it was heralded as a shiny beacon, as an example, of what mixed use should be." (CITY OF IRVINE 12-09-2009). With the new, single owner a more sustainable, and thus more MXD-appropriate, design may be facilitated that makes the development shine again. In general, institutions and planners can learn from the case of Park Place how they can help design mixed use developments sustainably, thereby achieving SB 375's goals, and contributing a small portion to slowing down the pace of the climate change to help improve peoples' lives.

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Table A: Theories applied, and their assumptions and critics

Theory	Main implication	Assumptions	Critics
Central place theory[17]	- Cities are distributed in space according to a hierarchy of goods they offer - they form hexagons of market areas with cities offering higher order goods having larger market areas	- evenly distributed population and resources - perfect competition - transportation costs proportional to distance and equal in all directions - homo oeconomi-cus (rational thinking human) who buys goods at the nearest center	- most assumptions unrealistic - Christaller's theory explains why there is a hierarchy of places, but not their absolute spatial distribution
Time-space-prism[18]	- individual as unit of study - people may act in time and space and face a tradeoff between both - thus humans' activities are restricted by constraints	- time as main travel impedance - other dimensions making up the space-time-prism: matter and space	- people are "actors and not just victims of environmental circumstances" - descriptive theory - intangible aspects are missing
Dynamization of central places[19]	- people are forced to couple purchases due to time restrictions - central places that have a higher coupling potential attract more consumers	- utility maximization - time is a cost factor - rising incomes - Engel curves	- influence of type of good not considered - shopping is the only activity covered
Product groups[20]	- convenience goods: standardized, thus comparison costs would be higher than derived utility - specialty goods: goods with limited market demand forcing consumers to take a special purchasing effort - convenience goods may also be specialty goods	- a consumer faces a tradeoff between utility derived from the product and disutility derived from search costs	- spatial dimension not considered - other costs and utility may be at play (travel cost, but also travel utility)

[17] cf., e.g., KULKE 2004, pp. 131ff.; HEINRITZ *et al.* 2003, pp. 135ff.; KAGERMEIER 1991, pp. 14ff.; O'BRIEN & HARRIS 1991, pp. 71ff.)
[18] cf., e.g., KAGERMEIER 1991, p. 16; GATHER *et al*. 2008, pp. 164ff.; ZIEHE 1998 pp. 72ff.), for critics see HÄGERSTRAND 1989
[19] cf. LANGE 1973; KULKE 2004, pp. 161ff.
[20] cf. HOLTON 1958

Figure A: Survey instrument: questionnaire

#: Date: Time:

1. **How often in one month do you visit a grocery store? (please write down the total number of visits, even if you visit more than one grocery store a day)** _____ times per month

2. **Out of this number, how often do you visit the grocery store at Park Place?** ____ times per month

Now think of the grocery store you visit the most often (store name): [ ]

3. **Is this grocery store located at Park Place?** ○ Yes ○ No → **Please proceed with question 6**

3.1 Why don't you visit the grocery store at Park Place (that often)/Why do you visit it at all:

[ ]

4. **From where do you usually begin your shopping trip to this grocery store?**
(Where have you been before?) Please check off below the location you begin from most often.
If you do not check "Home", please specify the location by a cross street and/or name of a place.
○ Home ○ office/work ○ Other (please specify): _____

Name of the place:
Street: Crossing street:

5. **Imagine your usual grocery shopping trip to Park Place: Would the distance from the beginning of this trip (question 4) to the grocery store here allow you to walk/cycle?**
○ Yes ○ No, it is too far, I rather drive → **Please Proceed with question 8**

5.1 Do you actually walk/cycle frequently to shop for groceries? ○ Yes ○ No, I rather drive

5.2 Please take a second and write down what discourages you from walking/cycling.

[ ]

6. **Where is this grocery store located and how often do you visit it?**

Grocery store location:		How often do you visit this shop?
Street:	Crossing Street:	____ times per month

7. **Why do you visit this store more often than the one at Park Place/visit the store here at all?**

[ ]

Figure A (cont.)

#: **Date:** **Time:**

8. **From where do you usually begin your shopping trip to this grocery store?**
(Where have you been before?) Please check off below the location you begin from most often.
If you do not check "Home", please specify the location by a cross street and/or name of a place.

○ Home ○ office/work ○ Other (please specify): _____

Name of the place:
Street: Crossing street:

9. **How important are the following reasons for your choice of this grocery store?**
Please rate the importance of the following reasons for your choice to shop at this grocery store in checking off the boxes applicable. "Proximity to other" and "Other" is optional.

	NOT AT ALL IMPORTANT for my choice								VERY IMPORTANT for my choice
Choice of products									
Quality of products									
Low prices									
Organic food									
Proximity to home									
Proximity to work									
Proximity to other (specify): _____									
Other: _____									

10. **How satisfied are you with the Shopping Center at Park Place, and adjacent areas in general?**
Please check the grade that you would give: 1 = very much 6 = not at all

1	2	3	4	5	6

11. **Please write down whether you miss something at the Shopping Center at Park Place and adjacent areas and/or any suggestions on ways that it could be improved!**

12. **Your year of birth?** _____ **You are?** ○ male ○ female

Figure B: Guided-interview questions (Mother's Market)

1. When has Mother's Market been founded? When Mother's Market Irvine? Which store was it?
2. Why has the location at Park Place been chosen for Mother's Market?
3. Do you know why Mother's Market has been approved as tenant at Park Place?
4. Do you have any kind of social responsibility codex?
5. What do you think could Mother's Market do to incentivize their customers to walk to the store?
6. What do you think about complementary stores at Park Place?

Figure C: Guided-interview questions (City of Irvine)

1. What are Irvine's goals for the IBC?
2. How was Park Place intended to contribute to these goals?
3. Would you please outline the history of Park Place?
4. Why has Mother's Market been approved as tenant for Park Place?
5. How do you think could people be incentivized to walk to the store? What do you think about additional complementary stores at Park Place?

Table B: Crosstabs of the most important variables

		RC	OC	total
GENDER	male	48%	18%	29%
	female	52%	82%	71%
AGE (Mdn)		**50**	**48**	**49**
AGE (bins)	< 35	13%	22%	18%
	35 - 49	35%	26%	29%
	50 - 64	35%	41%	39%
	65+	17%	11%	13%
TOTAL TRIP FREQUENCY per month (mean)*		**11.1**	**9.4**	**10.0**
FREtot_c (bins)	< once a month	0%	0%	0%
	< once a week	4%	8%	7%
	once to twice a week	41%	51%	48%
	> twice a week	54%	41%	46%
TRIP FREQUENCY to PST (mean)**		**7.2**	**5.8**	**6.3**
FREpst (bins)	< once a month	2%	1%	2%
	< once a week	13%	22%	18%
	once to twice a week	54%	58%	57%
	> twice a week	30%	19%	23%
DISTANCE to PST in meters (mean)***		**4,859**	**4,009**	**4,333**
DISpst (bins)	<= 1 km	13%	18%	16%
	> 1 km	38%	44%	42%
	> 5km	29%	31%	30%
	> 10 km	20%	7%	12%
MKT to PST (mean)****		**35.84**	**20.99**	**26.58**
MKTpst (bins)	< 10 km	20%	29%	26%
	< 20 km	18%	28%	24%
	< 50 km	38%	29%	33%
	=> 50 km	24%	13%	18%
Activity at trip origin	home	65%	67%	66%
	work	22%	23%	22%
	other	13%	10%	11%
interview weekday	weekday	74%	73%	73%
	weekend	26%	27%	27%
interview daytime	morning	41%	31%	35%
	lunchtime	13%	23%	19%
	afternoon	22%	30%	27%
	evening	24%	16%	19%
Total (N)		**46**	**74**	**120**

outliers: * values ≥ 40 excluded (n=45 (MMI) / n=72 (OTH)) **values ≥ 25 excluded (n=44/72)
*** values ≥ 15,000 excluded (n=40/65) **** FREpst > 25 and DISpst > 15000 excluded (n=38/63)

Source: own survey 11/2009

Table C: Consumers' mode choice and reasons of trips to MMI

Case number	RC/ OC	Meters to MMI	Walk?	Walkable?*	Reasons and comments for walking/not walking	Reason categorized
11	OC	1263	no	yes	comes in lunch break, not enough time	time
47	RC	130	no	yes	shops at Mother's on the way home	coupling
51	OC	547	no	yes	is usually in a hurry	time
55	RC	752	no	yes	walks only at night, when it is cooler and there are less "dump people" around	other
61	RC	800	no	yes	foot injured at time of survey	other
64	OC	1349	no	yes	Mother's is across the freeway	barrier
67	OC	1318	no	no	is going somewhere after shopping	coupling
87	OC	794	no	yes	walks only for lunch because parking lot is busy then	convenience
114	RC	521	no	no	walks only for pleasure, it is too cumbersome to wear heavy bags	convenience
120	OC	367	no	yes	shops at Mother's on the way home	coupling
27	OC	654	yes	yes	gives me a good walk in the sun	enjoyment
30	RC	1077	yes	yes	traffic on the Loop Road problem	barrier
37	OC	894	yes	yes	walking feels good, and she has the opportunity to walk, crossing Jamboree is an issue	enjoyment, barrier
59	OC	49	yes	yes	parking lot crowded, people not paying attention	barrier
66	RC	1161	yes	yes	usually car and running errands, because he already is on his way	coupling
97	OC	563	yes	yes	nice	enjoyment
100	RC	668	yes	yes	usually comes by car because he has so much to carry	convenience

* according to consumer: does the distance allow for walking?

Source: own survey 11/2009

ERKLÄRUNG / DECLARATION

Ich erkläre, dass ich die vorliegende Arbeit selbständig und nur unter Verwendung der angegebenen Literatur und Hilfsmittel angefertigt habe. Die aus fremden Quellen direkt oder indirekt übernommenen Inhalte sind als solche kenntlich gemacht.

I hereby declare that I prepared the present paper only with the help of the stated references and resources. Content that was directly or indirectly adopted from alien sources, are marked as such.

Berlin, den 05.12.2010

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